



Mossville Plant Complex and Tech Center

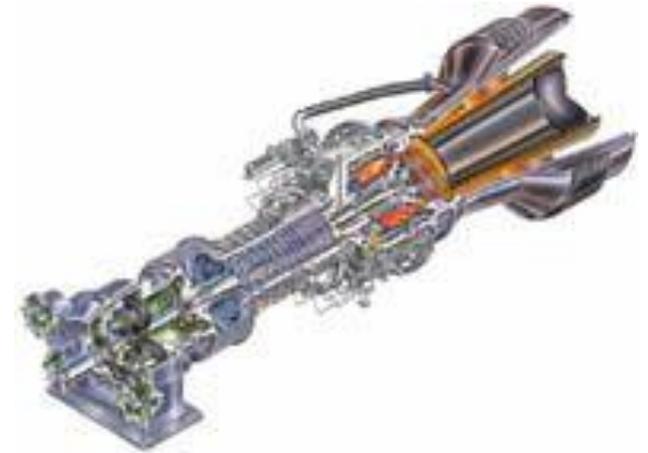
Modernization & Optimization of Existing CHP Facility

June 27, 2017



Project Objectives

1. **Develop dispatch models to maximize economic benefit**
2. **Develop and analyze system enhancements**
3. **Implement cost effective improvements**



Mossville Cogeneration Plant Summary

- Area Served = 2.5 million square feet
- Electric Generation (15kV)

	Installed	Operational
CT No. 1	13.5 MW	13.5MW
CT No. 2	13.5MW	13.5MW
CT No. 3	13.5MW	13.5MW
STG No. 1 (600 to 15psig)	5.2MW	5.2MW
STG No. 2 (600 to 250psig)	3.0MW	---
Total	48.7MW	45.7 MW

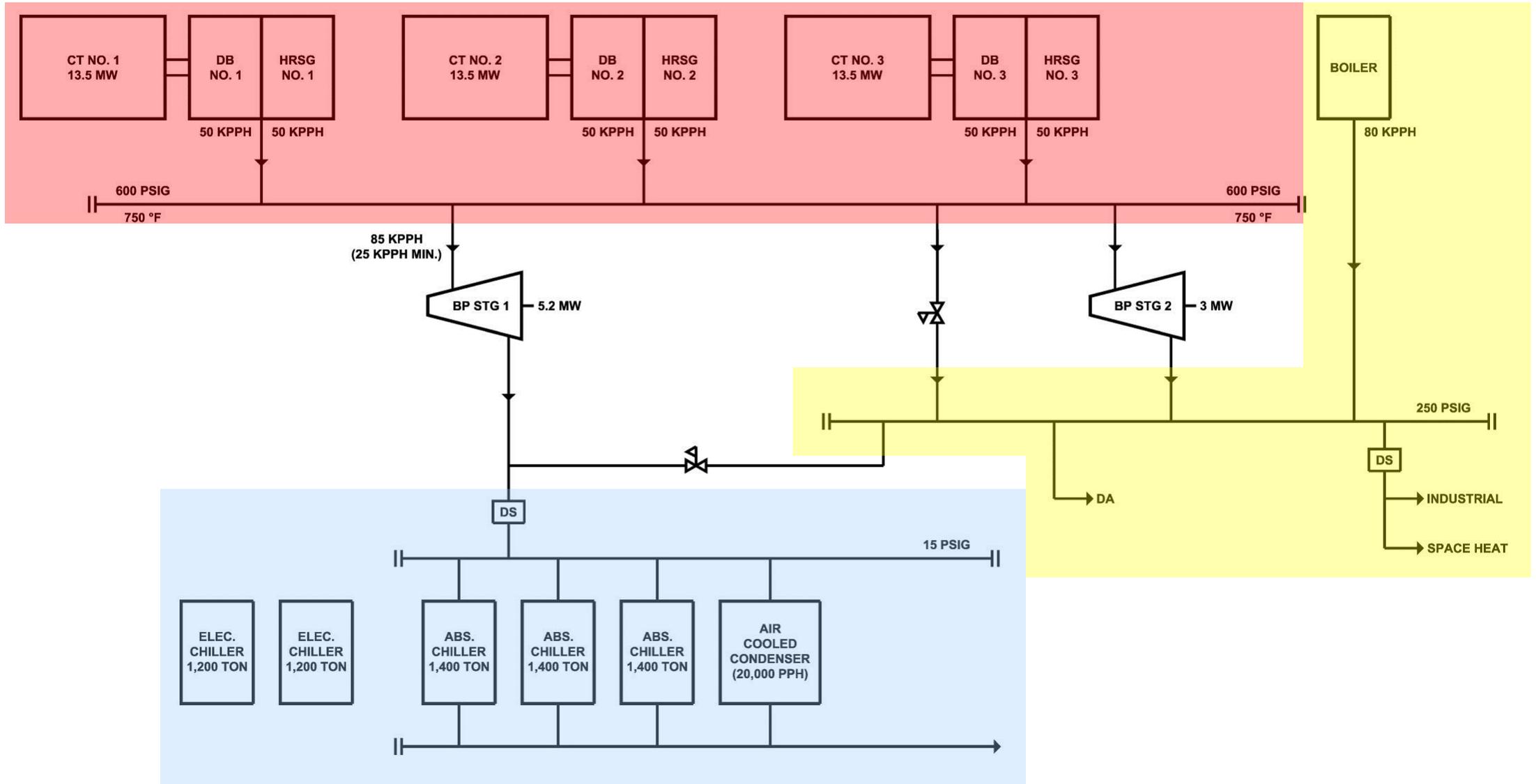
- Steam Generation

HRS No. 1 (600psig/750°F)	100,000PPH	100,000PPH
HRS No. 2 (600psig/750°F)	100,000PPH	100,000PPH
HRS No. 3 (600psig/750°F)	100,000PPH	100,000PPH
Boiler No. 1 (250psig SAT)	100,000PPH	80,000PPH
Total	400,000PPH	380,000PPH

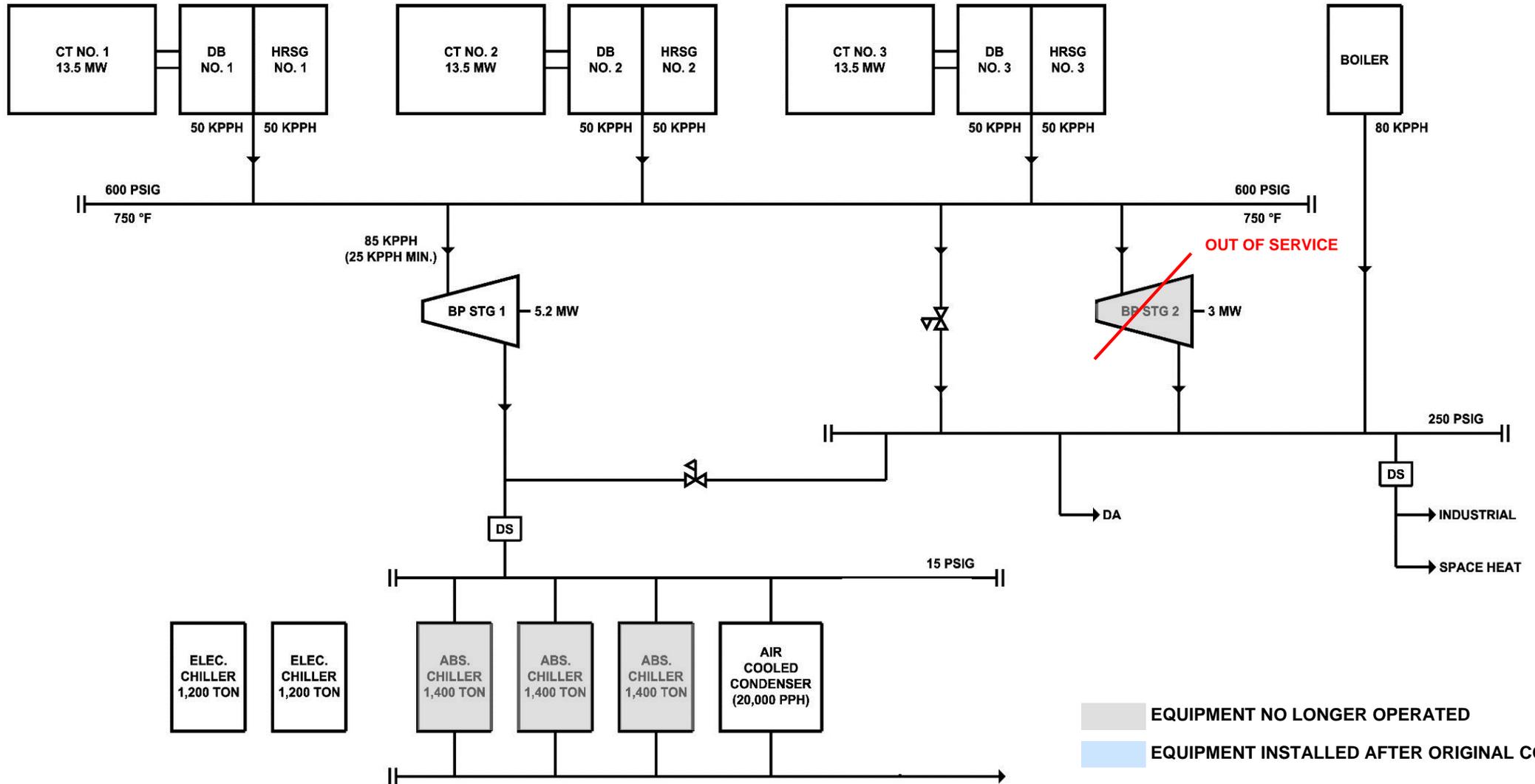
- Chilled Water

Elect. Chiller No. 1	1,200 Tons	---
Elect. Chiller No. 2	1,200 Tons	---
L.P. ABS Chiller No. 1	1,400 Tons	---
L.P. ABS Chiller No. 2	1,400 Tons	---
L.P. ABS Chiller No. 3	1,400 Tons	---
Total	6,600 Tons	---

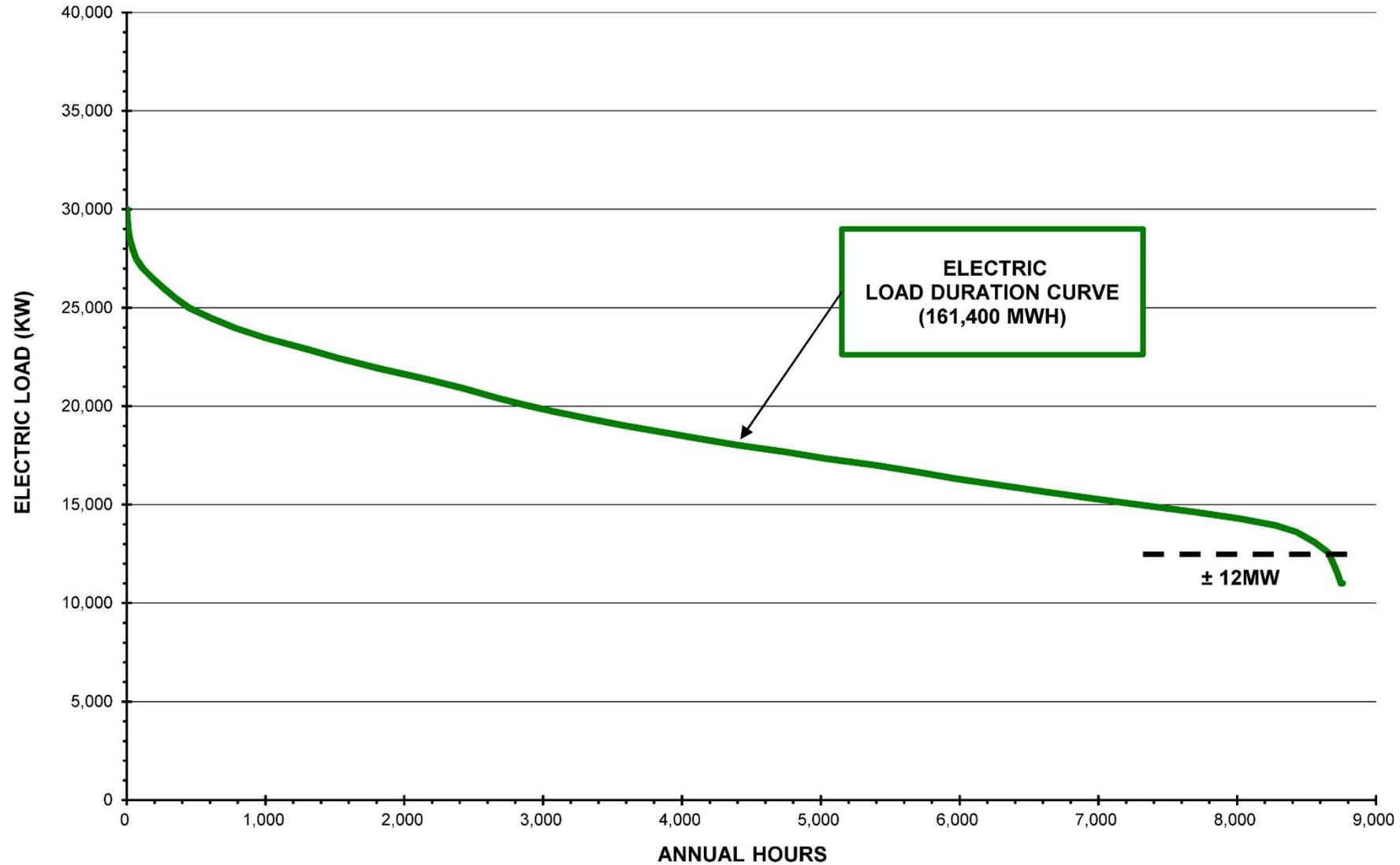
ORIGINAL COGENERATION PLANT



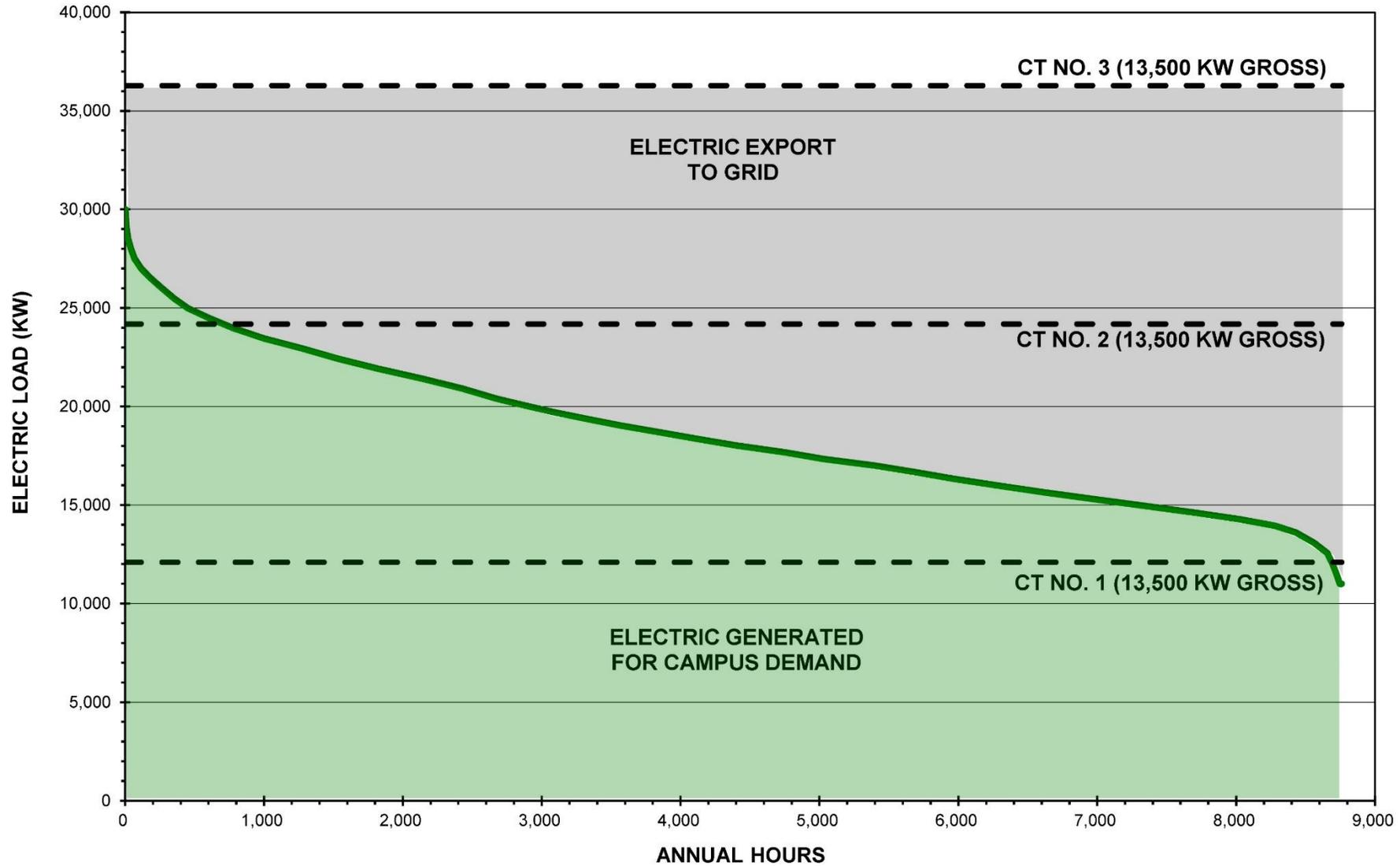
EXISTING COGENERATION PLANT



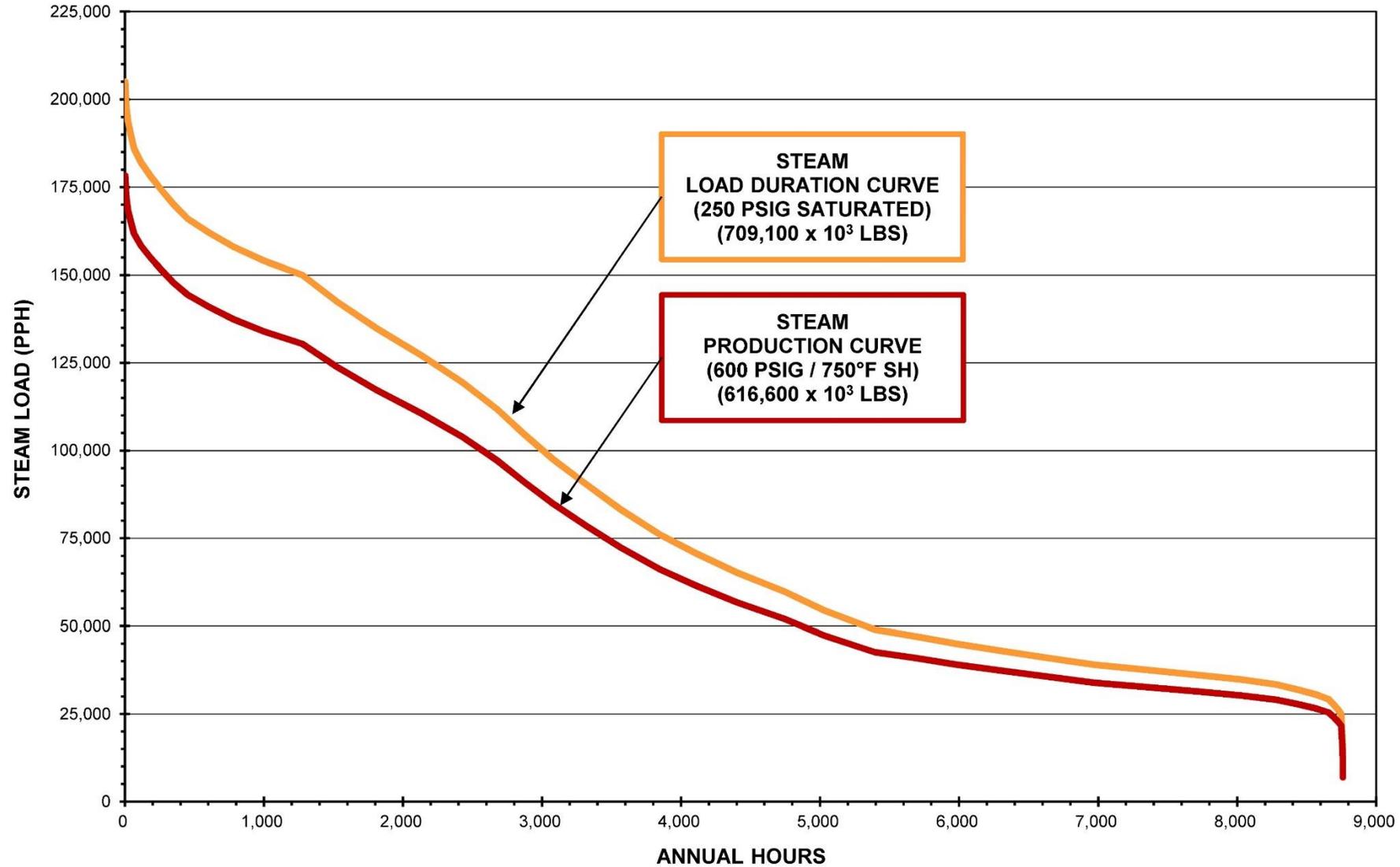
ANNUAL ELECTRIC LOAD DURATION CURVE (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



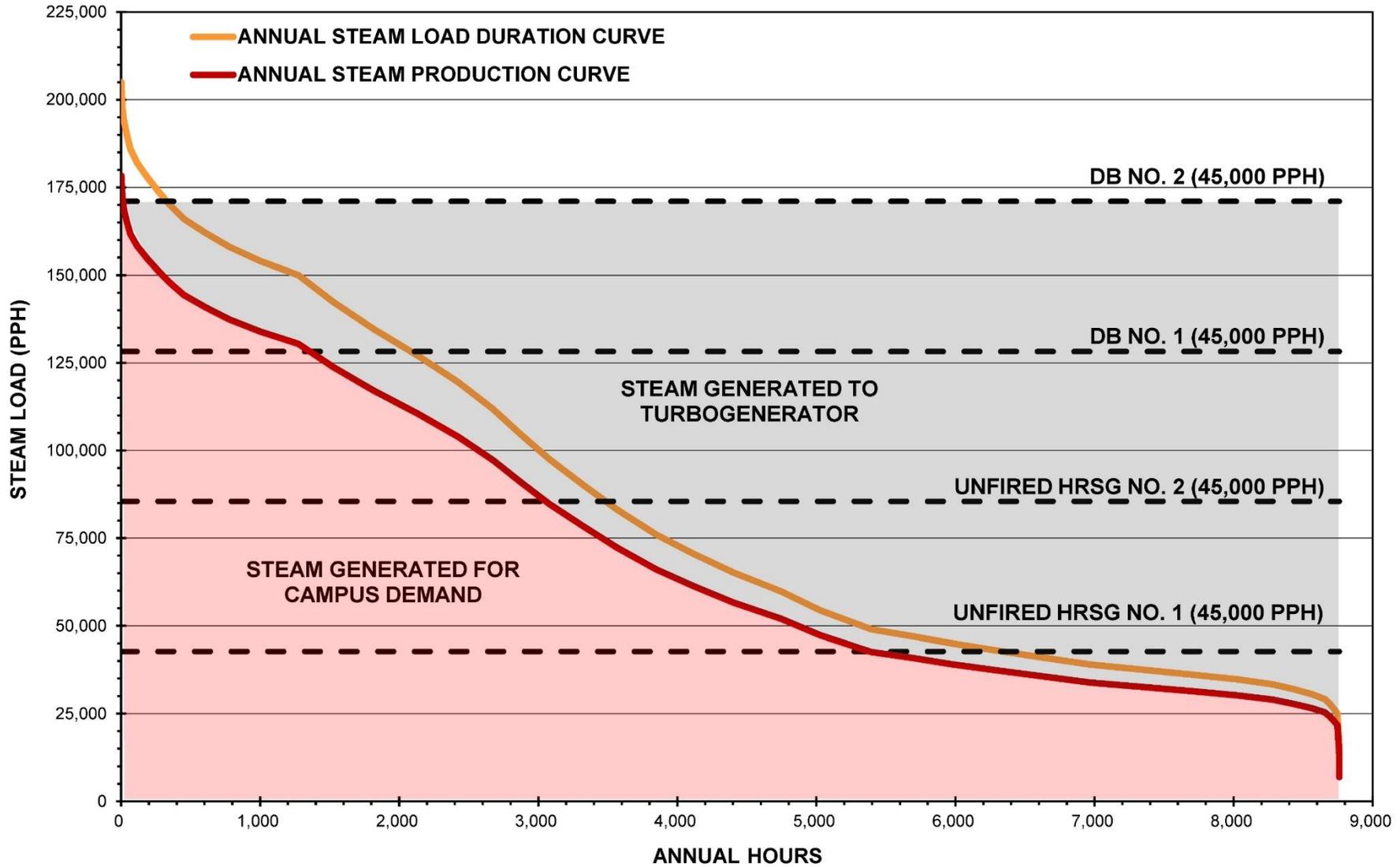
ANNUAL ELECTRIC LOAD DURATION CURVE (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



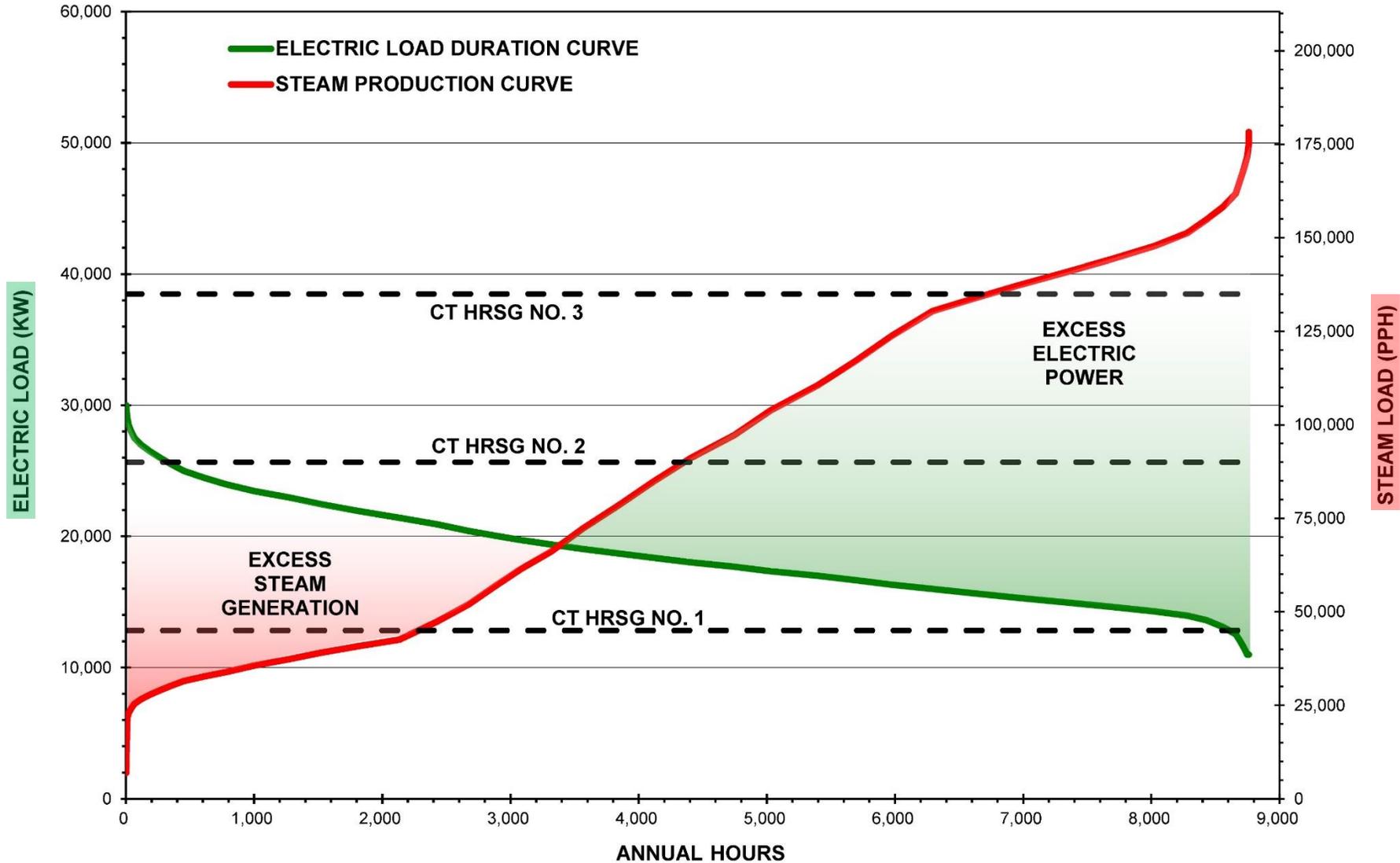
ANNUAL STEAM LOAD DURATION CURVE (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



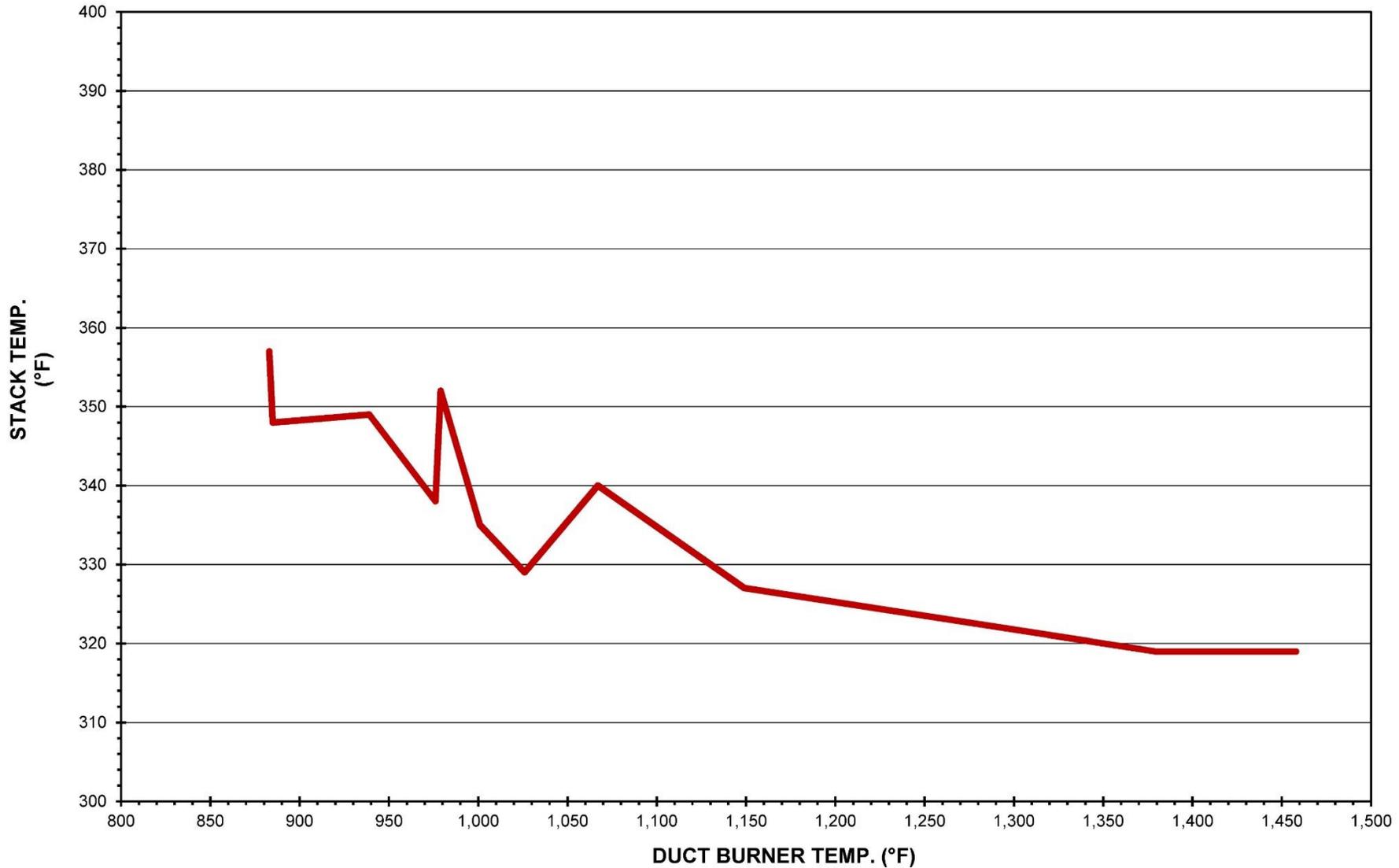
ANNUAL STEAM LOAD DURATION CURVE (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



OVERLAYED LOAD DURATION CURVES (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



HRSG STACK TEMPERATURE RECORDINGS BY CAT (CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER)



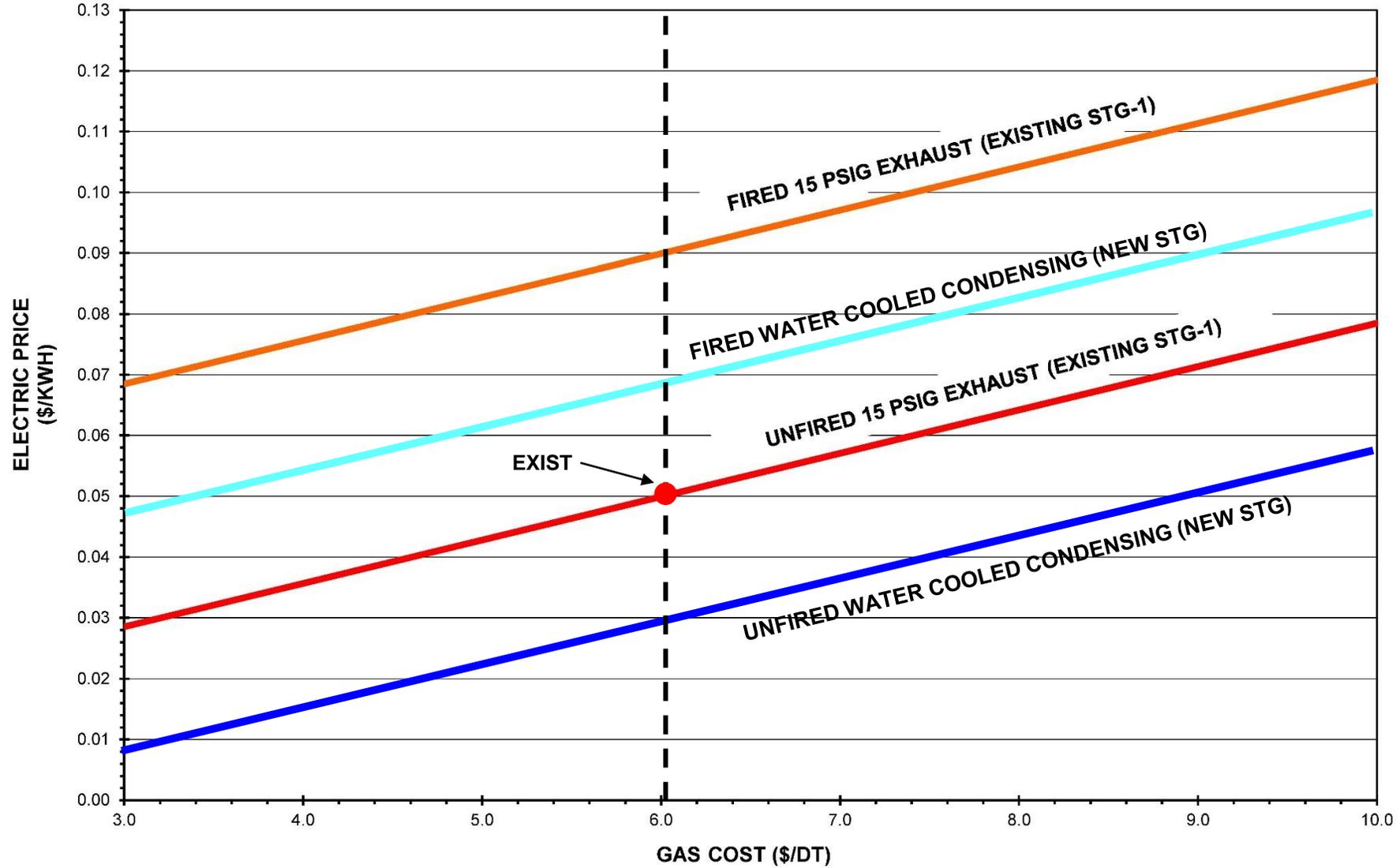
**COMBINED POWER CYCLE OUTPUT AND HEAT RATE
CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER**

COMPONENT	UNFIRED HRSG				FIRED HRSG			
	2 PSIA COND.		15 PSIG COND.		2 PSIA COND.		15 PSIG COND.	
	ELECTRIC (KW)	GAS (10 ⁶ BTU/HR)	ELECTRIC (KW)	GAS (10 ⁶ BTU/HR)	ELECTRIC (KW)	GAS (10 ⁶ BTU/HR)	ELECTRIC (KW)	GAS (10 ⁶ BTU/HR)
CT	13,510	148.0	13,510	148.0	13,510	148.0	13,510	148.0
DUCT BURNER	---	---	---	---	---	65.7	---	65.7
AUXILIARIES	(780)	---	(780)	---	(1,215)	---	(1,215)	---
ADD BFW HEAT	---	5.5	---	---	---	11.0	---	---
COND. STG	4,895	---	3,040	---	9,790	---	6,080	---
TOTAL	17,625	153.5	15,770	148.0	22,085	224.7	18,375	213.7
HEAT RATE	8,709 BTU/kWh		9,384 BTU/kWh		10,174 BTU/kWh		11,630 BTU/kWh	

NOTE: DATA AT ISO FOR A SINGLE UNIT

COMBINED POWER CYCLE FUEL COST

CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER



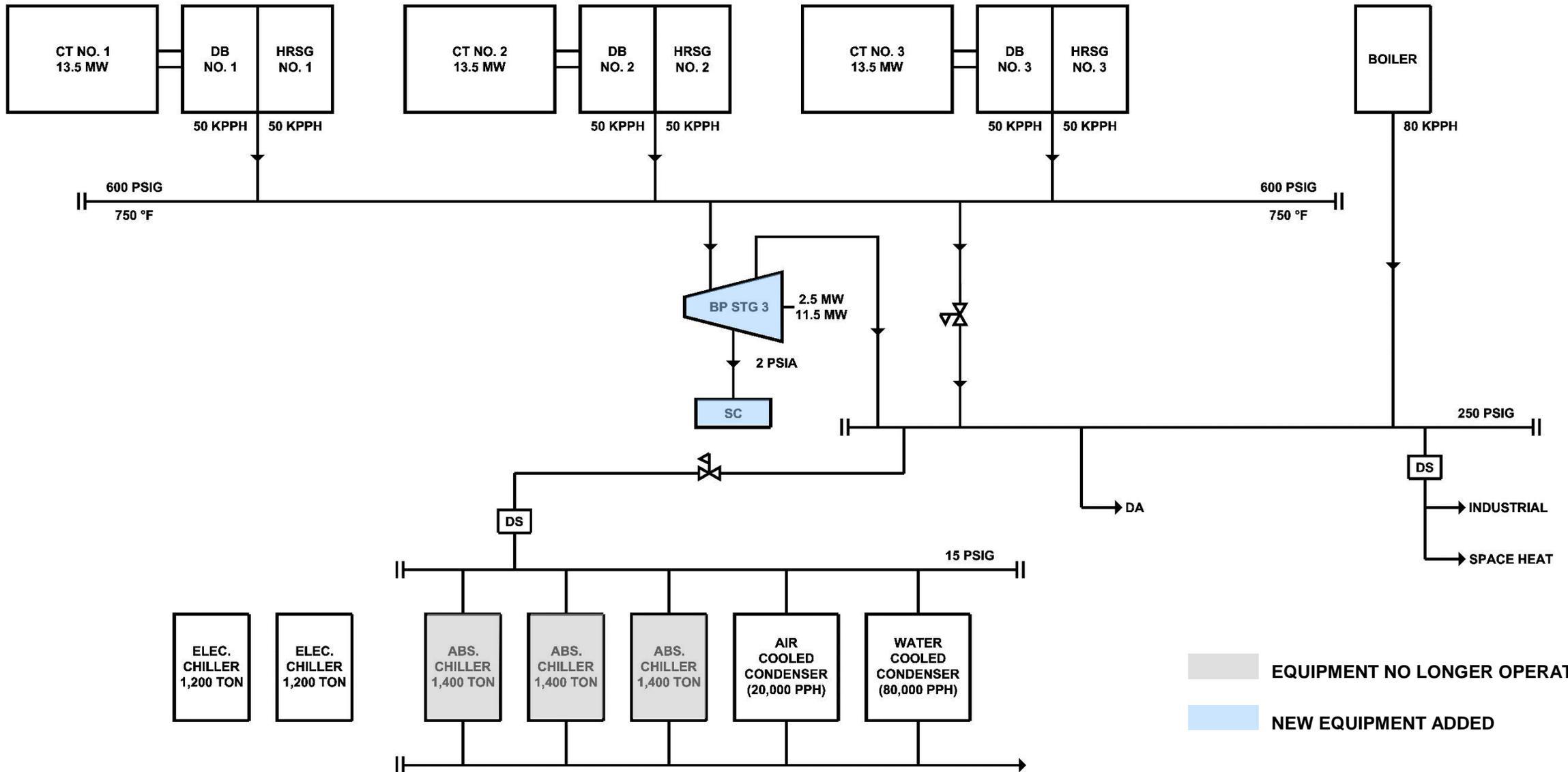
**PRELIMINARY STEAM TURBINE GENERATOR ANALYSIS
CATERPILLAR MOSSVILLE PLANT COMPLEX & TECH CENTER**

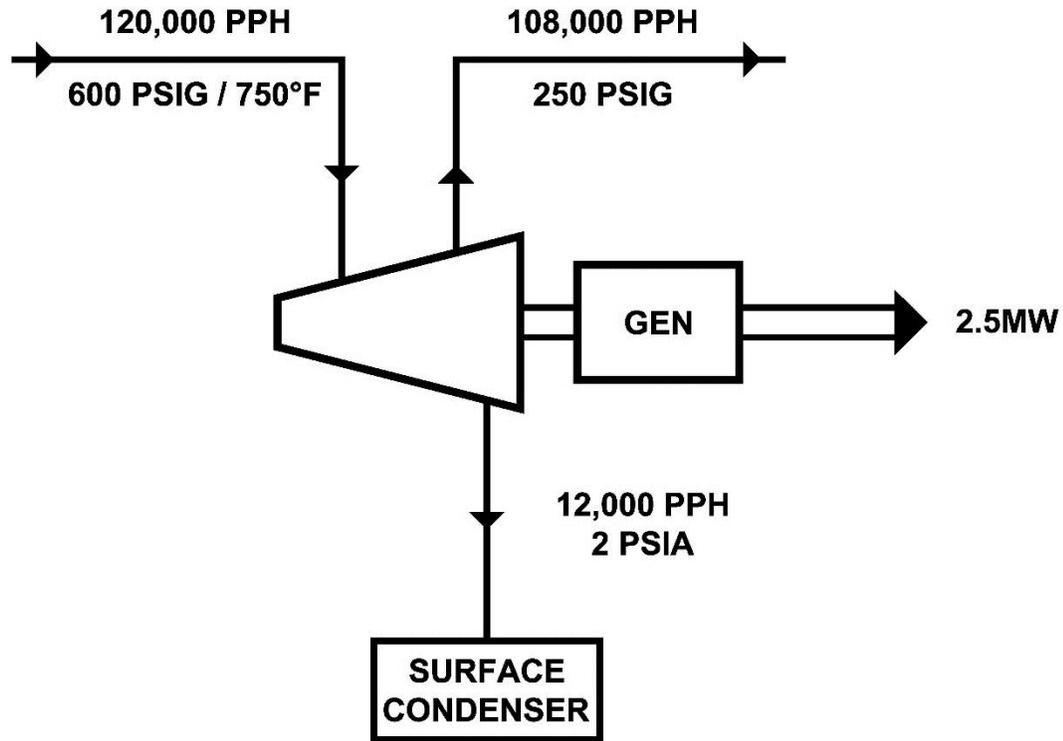
OPTION NO.	DESCRIPTION			INITIAL COST (\$1,000)	STG SAVINGS		NET PRESENT VALUE OF SAVINGS (\$1,000/YR)	PRIORITY
	STG NO. 1 (MW)	STG NO. 2 (MW)	STG NO. 3 (MW)		ANNUAL (\$1,000/YR)	PRESENT VALUE (\$1,000/YR)		
1	5.2	---	---	---	348	6,793	6,793	5
2	5.2	3.0	---	3,200	793	15,479	12,879	3
2A	5.2	3.0	3.0	5,500	915	17,861	12,261	4
3	---	---	11.5	5,000	926	18,075	13,075	1
4	---	---	17.9	7,800	1,068	20,847	13,047	2

NOTES:

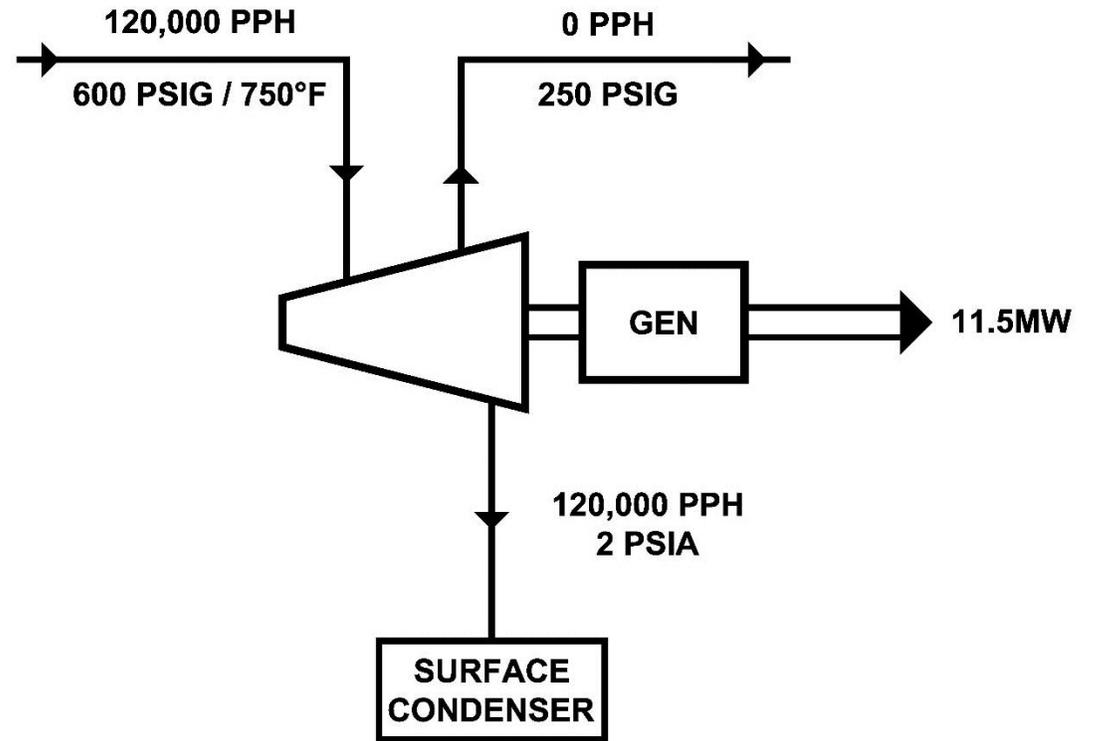
1. STG NO. 1 EXISTING
2. STG NO. 2 REPLACEMENT FOR EXISTING STG NO. 1
3. STG NO. 3 NEW EXTRACTION/CONDENSING STG
4. PRESENT VALUE FACTOR OF 19.52 BASED UPON 25 YEARS AND NET INTEREST RATE OF 2%
(COST OF CAPITAL LESS FUEL ESCALATION)
5. NEW EQUIPMENT

PRESENT CAT COGEN PLANT

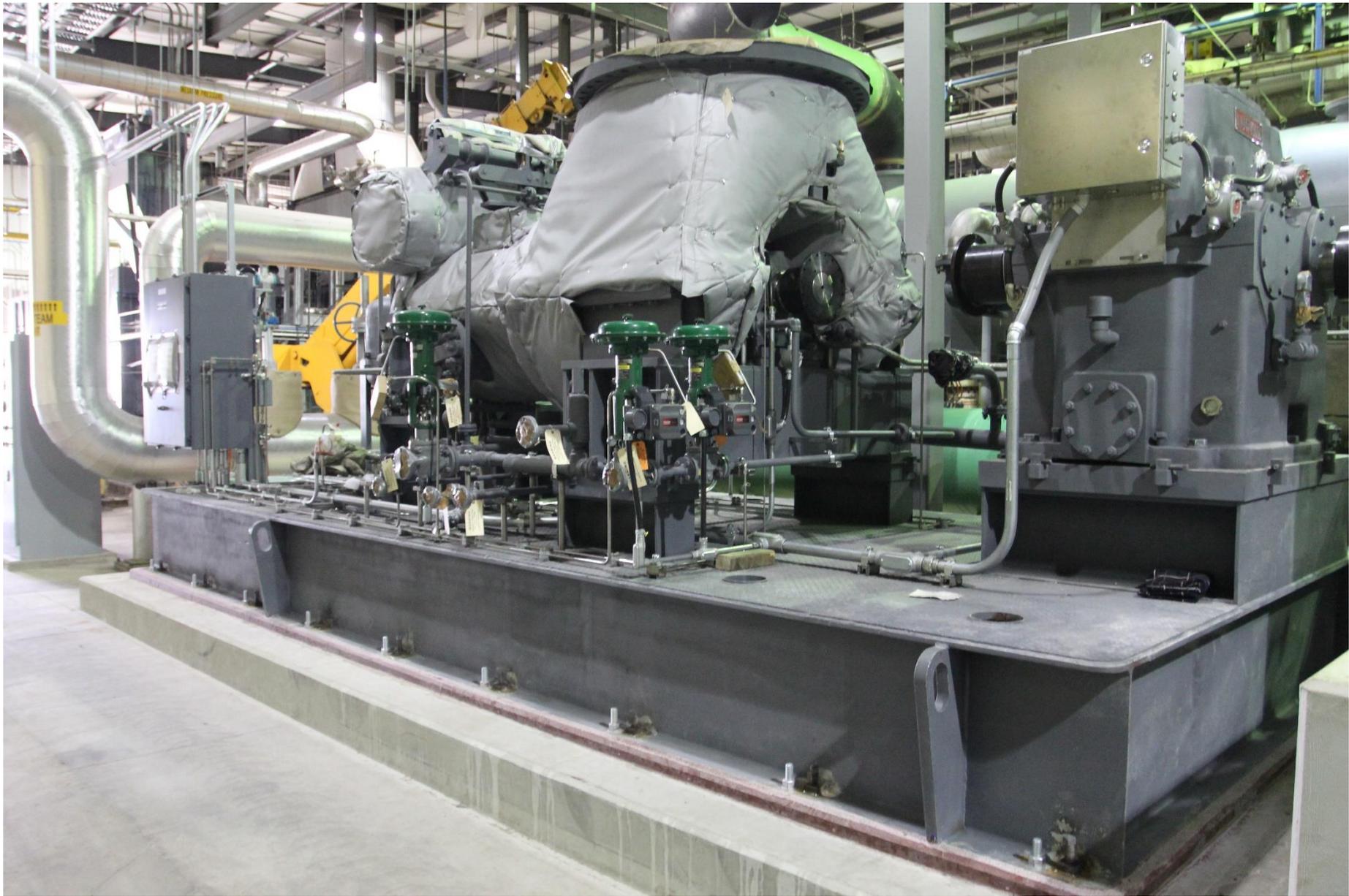




FULL EXTRACTION



FULL CONDENSING









Project Conclusions

1. Existing CAT dispatch model was perfect
2. Investigated various improvements
3. Installed new steam turbine generator
 - 11MW
 - 250psig extraction
 - 2psia condensing
 - Savings of \$930,000 per year

